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Prevalence and predictors of injection drug use and risky sexual behaviors among adolescents in substance treatment:

Prevalence and predictors of IDU and risky sex

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Abstract

Background and Objectives—The longitudinal risk for human immunodeficiency virus (HIV) infection following adolescent substance treatment is not known. Therefore, it is not known if adolescent substance treatment should include HIV prevention interventions. To address this important research gap, this study evaluates the longitudinal prevalence and predictors of injection drug use (IDU) and sex risk behaviors among adolescents in substance treatment.

Methods—Participants were 260 adolescents (13-18 years) in substance treatment and 201 community control adolescents (11-19 years). Participants were assessed at baseline and follow-up (mean time between assessments=6.9 years for the clinical sample and 5.6 years for the community control sample). Outcomes included self-report lifetime history of IDU, number of lifetime sex partners and frequency of unprotected sexual intercourse.

Results—At baseline, 7.5% of the clinical sample, compared to 1.0% of the community control sample had a lifetime history of IDU (χ_1^2=10.53, p=0.001). At follow-up, 17.4% of the clinical sample compared to 0% of the community control sample had a lifetime history of IDU (χ_1^2=26.61, p=0.0005). The number of baseline substance use disorders and onset age of marijuana use significantly predicted the presence of lifetime IDU at follow-up, after adjusting for baseline age, race, and sex. The clinical sample reported more lifetime sex partners and more frequent unprotected sex than the community control sample at baseline and follow-up.

Conclusions—Many adolescents in substance treatment develop IDU and report persistent risky sex. Effective risk reduction interventions for adolescents in substance treatment are needed that address both IDU and risky sex.

Keywords

Adolescent; Injection Drug Use; HIV; Substance treatment

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Background and Objectives

Human immunodeficiency virus (HIV) infection is an important public health problem for youth because persons under 25 years of age account for 20% of all new infections.[1] Two main risk factors for contracting HIV are injection drug use (IDU) and risky sex.[1] IDU accounts for 8-13% of all new HIV infections while risky sex accounts for 89-95%.[1]

It is not clear how many adolescents in substance treatment have IDU. However, late adolescence and young adulthood is an important time for the development of IDU because: 1) among adults with current IDU, the mean age of first IDU is 20 years; 2) adolescent-onset injection drug users (<21 years) have riskier IDU behaviors (e.g. more receptive needle sharing) than adult-onset injection drug users; and 3) early IDU initiation (<21 years) compared to later initiation is associated with a 40% increase in the odds of being HIV seropositive.[2-5]

Risky sexual behavior is another important risk factor for HIV infection. Having sex with multiple partners and not using condoms are especially common in adolescents who use substances.[6-16] These behaviors, particularly if they persist into young adulthood, represent additional risk for developing and transmitting HIV.

Despite evidence that IDU frequently develops during late adolescence and young adulthood and that adolescents in substance treatment frequently have risky sex, only half of adolescent substance treatment programs offer HIV risk assessment (56%) or HIV risk reduction interventions (57%).[17] One possible explanation for the lack of HIV interventions in adolescent substance treatment is the lack of data describing the longitudinal outcome and predictors of HIV risk behaviors among these adolescents.

The existing literature reports on few longitudinal samples of HIV risk among adolescents in substance treatment. We could find no studies assessing baseline prevalence of IDU and frequency of IDU onset for adolescents in substance treatment. With respect to risky sex, behaviors such as non-condom use and having multiple sex partners persist for at least 12 months following adolescent substance treatment, and conduct disorder predicts persistence of these behaviors.[18,19] However, we could not find studies that followed a sample longer than 12 months.

More is known about the longitudinal course of HIV risk in non-treatment seeking samples. Predictors of IDU from adolescent samples are not known but predictors of future IDU derived from non-treatment seeking samples of adult drug users include: early onset substance use, high school drop out, high intensity of substance use, past history of IDU, peer influence to inject and risky sex.[20-24] Studies of non-treatment seeking adolescents show the following predictors of risky sex: age onset of sexual intercourse, age onset of substance use, association with deviant peers, decreased parental monitoring, depressive symptoms and baseline risky sexual behavior.[25-32] However, most of these predictor variables have not been evaluated in adolescents undergoing substance treatment.

In summary, there is little information on the baseline prevalence of IDU and the long-term HIV risk and predictors of HIV risk for adolescents in substance treatment. This information is crucial to inform whether or not HIV risk should even be addressed in adolescent substance treatment. In fact, some researchers have proposed that adolescent substance treatment alone might reduce HIV risk.[33] Longitudinal data would also inform the important clinical questions of which HIV risk behaviors should be addressed and which adolescents in substance treatment are most in need of HIV risk reduction interventions. To our knowledge, this study is the first long-term (greater than 12 months) evaluation of HIV risk in adolescents enrolled in substance treatment and includes a large clinical sample and a

matched community control group. It also assesses HIV risk due to both IDU and risky sex and assesses not just risky sexual behaviors but attitudes and social norms. Therefore, the findings from this study represent a unique opportunity to address the important research gaps outlined above.

Methods

Baseline participants

Participants were recruited from 1997 to 2001 and were part of a genetics study of adolescent-onset substance use disorders in patients, families, twins and adoptees.[34] The clinical sample (n = 260) consists of adolescents admitted to a Denver area substance treatment program operated by the Division of Substance Dependence at the University of Colorado. The treatment program offers both outpatient and residential treatment. Most patients in this treatment program are referred by juvenile justice or social services for serious conduct and substance use disorders. Inclusion criteria for the study were: 1) age between 13 and 19 years; 2) ability to understand and provide written, informed parental consent and minor assent, if under 18 years old, or individual consent if 18 years or older; 3) sufficient English ability to complete the assessments; and 4) enrolled in the substance treatment program. Exclusion criteria were: 1) imminent danger to self or others, 2) current psychotic symptoms and 3) no biological full sibling between the ages of 12 and 25 years.

The community control sample (n = 201) consisted of adolescents from 11 to 19 years old. Community participants were matched to 2/3 of male clinical participants and all of the female clinical participants by age (within one year), race/ethnicity, gender and ZIP code of residence. Community participants and their families were recruited through a private research firm by randomly querying public phone lists from specific ZIP codes (for a description of the sample, see Miles et al., 1998).[35] Inclusion and exclusion criteria for the community participants were the same as for clinical participants, with the exception that they were not enrolled in the previously mentioned substance treatment program, and they could be under the age of 13 years.

Participants followed at time 2

The follow-up interview for the clinical sample occurred a mean of 6.9 (SD=1.5) years later (range 5-10 years). Community controls had a similar follow-up time with a mean of 5.6 (SD=0.9) years (range 4-10 years). The response rate for the clinical sample was 75.0%. Reasons for non-participation were: refused (n=18, 6.92%), dead (n=5, 1.92%) and other (e.g. missing data, unable to locate) (n=42, 16.15%). The response rate for the community controls was 68.2%. Reasons for non-participation were: refused (n=40, 19.90%), dead (n=0, 0%) and other (e.g. missing data, unable to locate) (n=24, 11.94%).

Measures

Demographic information—Demographic information such as age, ethnicity and gender was collected with a standard pen-and-paper questionnaire.

Diagnosis of conduct disorder and substance use disorder—Conduct disorder symptoms were assessed with the Diagnostic Interview Schedule for Children (DISC) based on the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV) criteria.[36,37] DSM-IV substance use disorders were diagnosed with the Composite International Diagnostic Interview-Substance Abuse Module (CIDI-SAM).[38,39] Substance use disorders in nine categories (alcohol, amphetamines, cannabis, cocaine, hallucinogens, inhalants, opioids, PCP, and sedatives) were summed to create an aggregate measure of the number of substance abuse and dependence diagnoses. The CIDI-SAM was also used to

obtain information about substance use, such as onset age of using marijuana more than five times and lifetime history of IDU. These structured instruments have been shown to be valid assessments of conduct disorder and substance use disorders in similar samples.[40]

Assessment of attitudes, social norms and behaviors related to HIV sex risk— Attitudes and behaviors related to risky sex were assessed at baseline and follow-up with a pen-and-paper self-report assessment. The following questions assessed attitudes and social norms: “Think of all your friends of the same sex you are. How many of them have had sex (‘gone all the way’) (almost none, some of them, most of them, all of them)?”; “When people your age have sex, do they usually use some kind of protection against disease or pregnancy (almost all do, most do, some do, almost none do)?”; “How much peer pressure is there on people your age to have sex (none, a little, a fair amount, a lot)?”; “People my age are just too young to have sex (strongly agree, agree, disagree, strongly disagree)”; and “It's better not to have sex rather than to risk getting pregnant or a disease (strongly agree, agree, disagree, strongly disagree).” At follow-up, these questions about attitudes and social norms were only administered to participants who were not currently married or living with a partner because some of the questions were less applicable to those participants (e.g. People my age are just too young to have sex).

All participants, regardless of whether or not they were married or living with a partner, completed a self-administered pen-and-paper assessment about risky sexual behaviors at baseline and follow-up. Participants answered the question, “When you had sex/if you had sex before married, did you make sure that some kind of protection was used (almost always, most of the time, about half of the time, some of the time, hardly ever, and never)?” An unprotected sex variable was created by dichotomizing responses from this item into almost always versus not almost always uses protection and never had sex was combined with the almost always category. Participants also recorded the age at which they first had sex and the number of lifetime sex partners. Due to outlying values for number of lifetime sex partners, 22 observations 2.5 standard deviations above the mean were truncated.

Three HIV risk behaviors (IDU, multiple sex partners and unprotected sex) were assessed at follow-up. The variable for multiple sex partners was dichotomized as 20 or fewer sex partners versus 21 or more sex partners. The cutoff of 20 sex partners corresponds to approximately one standard deviation above the mean number of partners in large, community samples and has been used as a cutoff for multiple lifetime partners in other studies.[41,42] The variable measuring unprotected sex at follow-up was dichotomized as it was at baseline. Lifetime history of IDU at follow-up included intravenous, intramuscular and subcutaneous injection and was obtained from the computerized CIDI-SAM.

Procedures

Approval from the Colorado Multiple Institutional Review Board was obtained before beginning the study. Written, informed consent was obtained from all participants and parents/guardians of minor participants. The baseline and follow-up interviews were conducted confidentially, and participants were told that information would not be shared with parents, guardians or treatment providers.

Statistical Analyses

Data were edited and analyzed in SPSS version 19.0.[43] Pearson chi-square analyses and independent *t*-tests or Mann-Whitney U tests (when continuous data were not normally distributed) were used to compare the clinical and community control samples on baseline and follow-up demographic data, conduct disorder diagnosis, substance use disorder diagnoses, and HIV risk attitudes and behaviors.

To examine baseline predictors of follow-up HIV risk (IDU, multiple sex partners and unprotected sex), separate multiple logistic regressions were completed with each predictor variable (onset age of sex, onset age of marijuana use more than five times, number of conduct disorder symptoms and number of substance use disorder diagnoses, not including nicotine), while controlling for baseline age, sex and race. Candidate predictor variables were chosen based on previous literature showing them to be HIV risk factors in non-clinical adolescent samples.[22,28,44] Next, significant ($p < 0.05$) predictor variables from the separate models were combined in multiple logistic regressions using a stepwise procedure, while adjusting for baseline age, sex and race. Each significant variable was evaluated in a model with another significant variable. When two variables remained significant in a model, a third significant predictor was added, etc. Final models evaluated whether eliminating non-significant covariates appreciably changed significance of the predictors. These multiple logistic regressions were only completed in the clinical sample because a primary goal of the study was to provide predictors that clinicians could use to identify adolescent patients most in need of HIV risk reduction interventions.

Results

Sample Description

The comparison (Table 1) of baseline demographic and clinical characteristics of the two samples revealed that, in general, the clinical sample had a higher prevalence of conduct disorder and substance use disorders. In addition, the clinical sample had a significantly younger age of marijuana use onset.

Baseline HIV Risk

The comparison of the baseline HIV risk factors for the clinical and community control samples revealed that, in general, the clinical sample had significantly riskier attitudes, social norms and behaviors than the community sample (Table 2). Important differences between groups were seen in the proportion with a lifetime history of IDU, the proportion ever having sex, frequency of unprotected sex, number of lifetime sex partners and age of sex initiation.

Follow-up HIV Risk

Of the 260 clinical participants, 195 (75%) were re-interviewed. Of 201 community control participants, 137 (68.2%) were re-interviewed. Neither the clinical participants nore the community control participants who completed the follow-up interview differed from those who did not complete based on baseline age, gender, ethnicity, number of lifetime sex partners, lifetime IDU, race or unprotected sex. However, the percentage of white participants in the follow-up clinical group was greater than the percentage of white participants in clinical group that did not complete the follow-up interview (56.4% vs. 44.6%; $\chi_2^2 = 8.61$, $p = 0.014$).

Table 3 compares the clinical and community samples with respect to HIV risk attitudes, social norms and behaviors at follow-up. Overall, the clinical sample continued to have riskier attitudes, social norms and behaviors than the community control sample.

Baseline Predictors of Follow-up HIV Risk

Only the significant results of the multiple logistic regressions to determine baseline predictors of follow-up HIV risk are discussed. All analyses adjust for baseline age, sex and race. With respect to predicting IDU, the separate multiple logistic regressions revealed the following. There is a 21% decrease in the odds of ever injecting drugs at follow-up for every year sexual intercourse is delayed (AOR = 0.79, $p = 0.044$). The odds of ever injecting drugs

are decreased by 27% for every delayed year of marijuana initiation (AOR = 0.73, p = 0.001). For one additional conduct disorder symptom at baseline, the odds of ever injecting drugs at follow-up are increased by about 20% (AOR = 1.20, p = 0.020). One additional substance use disorder diagnosis (not including nicotine) at baseline increases the odds of ever injecting drugs at follow-up by approximately 63% (AOR = 1.63, p = 0.0005). The number of clinical participants with a lifetime history of IDU at follow-up was 34 (17.4%).

Table 4 reports the combined multiple logistic regression model predicting IDU at follow-up. After adjusting for all the variables in the model, the odds of ever injecting drugs at follow-up are decreased by about 20% for every year of delayed marijuana initiation. One additional substance use disorder diagnosis at baseline increases the odds of ever injecting drugs at follow-up by approximately 48%, after adjusting for all the variables in the model.

With respect to predicting multiple lifetime sex partners, one additional conduct disorder symptom at baseline increases the odds of having 21 or more lifetime sex partners by approximately 20% (AOR = 1.20, p = 0.007).

Conclusions and Scientific Significance

Summary of findings

These results show that, compared to a community control sample, adolescents in substance treatment more frequently engage in IDU both as adolescents and young adults. Most alarming, at follow-up, 17% of the clinical sample had a lifetime history of IDU. The baseline number of substance use disorder diagnoses and the onset age of marijuana use significantly predicted follow-up IDU. The clinical sample also had worse baseline and follow-up attitudes, beliefs and behaviors related to risky sex than the community control sample. The baseline predictor of multiple sex partners was the number of conduct disorder symptoms.

Relationship to previous findings

Concerning onset of IDU, previous research shows that 24-30% of non-treatment seeking adult drug users initiate IDU during a 2-year follow-up.[5,24] Our current findings contribute to the understanding of IDU onset by showing that a substantial proportion of adolescents with substance use disorders develop IDU even after undergoing substance treatment.

With respect to risky sexual behaviors, prior research shows that following residential substance treatment, adolescents frequently continue having sex with multiple partners and not using condoms at one year follow-up.[18,19,45] Our current findings extend the understanding of risky sex among youth in substance treatment by showing that these behaviors persist for up to 8 years and by evaluating various predictors of persistent sex risk such as onset age of sex, onset age of marijuana use, number of conduct disorder symptoms and number of substance use disorder diagnoses.

Clinical implications

Our findings have several important clinical implications. First, adolescents in substance treatment need IDU prevention. Currently, IDU prevention is not a routine part of adolescent substance treatment likely because, as our data show, few adolescents in substance treatment have IDU. However, our data show that almost one in five adolescents in substance treatment will develop IDU within approximately 8 years. Our data also show that youth with multiple substance use disorders and early marijuana use onset are especially in need of effective IDU prevention interventions.

Second, our data underscore the need for effective interventions to reduce risky sexual behaviors for adolescents in substance treatment. Prior research shows that substance treatment alone may reduce sex risk.[33] However, our findings show that substance treatment alone certainly does not eliminate risky sex. In fact, at follow-up 74% of our sample report not using protection almost always, and the mean number of lifetime sex partners was 16. Therefore, even if adolescent substance treatment alone reduces sex risk, adolescents in substance treatment need additional interventions to further reduce their risky sexual behaviors. Unfortunately, there is no proven sex risk behavior intervention for teens in outpatient substance treatment, where 86% of adolescent substance treatment takes place.[48]

Study limitations

There are several limitations to the current study. First, this study did not use a comprehensive, validated HIV risk assessment that obtained details about frequency of IDU, needle sharing or type of sexual intercourse. Second, there was not a variable specifically measuring condom use. Therefore, caution should be used when drawing conclusions about HIV risk from the unprotected sex variable. Finally, while those lost to follow-up appear similar to those not lost to follow-up at baseline, it is possible that those lost to follow-up developed more severe substance use disorders.

There are several factors which could influence the interpretation of the study findings. For example, while the study accounted for participants who were married or living with a partner, it did not ask participants if they were trying to get pregnant. Furthermore, sexual norms change over time. For example, from 1991 to 2009, the proportion of adolescents reporting ever having sexual intercourse (54 to 46%) and the proportion reporting intercourse with four or more persons (18.7 to 13.8%) decreased while the proportion reporting condom use during last intercourse increased (46.2 to 61.1%).[49]

Significance and Future Directions

There are several important and new clinical implications from this study. First, many adolescents in substance treatment develop IDU by young adulthood. Second, many adolescents in substance treatment have persistent, risky sexual behaviors. Finally, substance treatment alone does not eliminate these risky behaviors. Future research is needed to develop effective HIV risk reduction interventions that target both IDU and risky sex among youth in substance treatment, especially youth with multiple substance use disorders, early marijuana initiation, and many conduct disorder symptoms.

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Table 1
Baseline characteristics of the clinical and community control samples

Variable	Clinical N = 260 % (n) or mean (SD)	Community Controls N = 201 % (n) or mean (SD)	Statistic	p value
Gender				
Female	13.5 (35)	17.4 (35)	χ_1^2=1.37	0.241
Male	86.5 (225)	82.6 (166)		
Hispanic	35.0 (91)	34.8 (70)	χ_1^2=0.002	0.969
Race				
White	53.5 (139)	54.7 (110)	χ_2^2=0.16	0.923
Black	8.5 (22)	9.0 (18)		
Other (American Indian/Alaska Native, Asian and more than one race)	38.1 (99)	36.3 (73)		
Age at baseline interview (years)	15.7 (1.2)	15.7 (1.5)	$t_{368.79}$ =0.02	0.988
Conduct disorder	86.9 (226)	24.9 (50)	χ_1^2=181.65	0.0005
Number of conduct disorder symptoms	5.8 (2.8)	1.7 (2.2)	$t_{458.68}$=-17.86	0.0005
Cannabis use disorder	90.8 (236)	15.4 (31)	χ_1^2=264.05	0.0005
Alcohol use disorder	71.9 (187)	15.4 (31)	χ_1^2=145.18	0.0005
Nicotine dependence	59.2 (154)	7.5 (15)	χ_1^2=130.84	0.0005
Amphetamine use disorder	18.8 (49)	1.0 (2)	χ_1^2=36.72	0.0005
Cocaine use disorder	16.2 (42)	1.0 (2)	χ_1^2=30.17	0.0005
Opioid use disorder	6.9 (18)	0.5 (1)	χ_1^2=11.85	0.001
Number of substance use disorders (not including nicotine)	2.4 (1.5)	0.4 (0.8)	U=4583.50	0.0005
Onset age of marijuana use (years)	11.9 (2.0) (n=256)	13.3 (2.3) (n=63)	t_{317}=4.65	0.0005

Note: Sample sizes vary because of missing data.

Table 2
Baseline risk factors for HIV infection comparing clinical and community control samples

Item	Clinical N = 260 % (n) or mean (SD)	Community Controls N = 201 % (n) or mean (SD)	Statistic	p value
Lifetime history of IDU	7.5 (19) (n=255)	1.0 (2) (n=199)	χ_1^2=10.53	0.001
Proportion of friends having sex (all and most)	88.7 (227) (n=256)	28.0 (54) (n=193)	χ_1^2=173.10	0.0005
People my age are just too young to have sex (strongly disagree and disagree)	82.0 (210) (n=256)	44.9 (89) (n=198)	χ_1^2=68.28	0.0005
It's better not to have sex rather than to risk getting pregnant or a disease (strongly disagree and disagree)	47.1 (120) (n=255)	22.3 (44) (n=197)	χ_1^2=29.39	0.0005
When people your age have sex, do they usually use some kind of protection (almost none and some)	33.5 (85) (n=254)	14.5 (28) (n=193)	χ_1^2=20.86	0.0005
How much peer pressure is there on people your age to have sex (a lot and a fair amount)	50.4 (129) (n=256)	50.8 (100) (n=197)	χ_1^2=0.01	0.938
Unprotected sex (any response other than almost always uses protection or no sex)	49.6 (128) (n=258)	10.6 (21) (n=198)	χ_1^2=77.48	0.0005
Ever had sex	92.7 (240) (n=259)	33.8 (67) (n=198)	χ_1^2=176.11	0.0005
Onset age of sex (years)	13.1 (1.6) (n=239)	14.6 (1.6) (n=67)	U=4103.50	0.0005
Number of lifetime sex partners	6.2 (5.5) (n=256)	1.3 (3.0) (n=196)	U=6798.00	0.0005

Note: Some participants failed to answer all questions; n = the number of participants who responded to the question.

Table 3
HIV risk at follow-up in clinical and community control samples

Item	Clinical N = 195 % (n) or mean (SD)	Comparison Sample N = 137 % (n) or Mean (SD)	Statistic	p value
Lifetime history of IDU	17.4 (34)	0 (0)	χ_1^2=26.61	0.0005
Amount of friends having sex† (all and most)	94.6 (139) (n=147)	82.7 (86) (n=104)	χ_1^2=9.24	0.002
People my age are just too young to have sex† (strongly disagree and disagree)	91.8 (135) (n=147)	88.5 (92) (n=104)	χ_1^2=0.80	0.370
It's better not to have sex rather than to risk getting pregnant or a disease† (strongly disagree and disagree)	48.3 (71) (n=147)	41.7 (43) (n=103)	χ_1^2=1.05	0.306
When people your age have sex, do they usually use some kind of protection† (almost none and some)	46.9 (69) (n=147)	19.2 (20) (n=104)	χ_1^2=20.43	0.0005
How much peer pressure is there on people your age to have sex† (a lot and a fair amount)	40.1 (59) (n=147)	55.8 (58) (n=104)	χ_1^2=5.98	0.014
Unprotected sex (any response other than almost always uses protection or no sex)	73.7 (140) (n=190)	41.5 (51) (n=123)	χ_1^2=32.59	0.0005
Number of lifetime sex partners	16.3 (13.7) (n=186)	7.4 (10.9) (n=120)	U=4910.00	0.0005

Notes: sample sizes vary because some participants failed to answer all questions and n = the number of participants who responded to the question;

† These items were only completed by participants who were not currently married or living with a partner at follow-up.

Table 4

Multiple logistic regression in the clinical sample predicting lifetime IDU at follow-up, after adjusting for baseline age, race and sex

Predictor variable	B (SE)	AOR	95% C.I. for AOR	p value
Onset age of marijuana use	-0.22 (0.10)	0.80	0.65, 0.98	0.028
Number of substance use diagnoses (not including nicotine)	0.39 (0.14)	1.48	1.13, 1.94	0.004

Note: AOR=Adjusted Odds Ratio